

# Deuteron EDM Statistics

YK  
5/9/2003

$$|\bar{\omega}| = \frac{|\vec{d} \times (\vec{v} \times \vec{B})|}{\hbar/2}$$

$$|\bar{\omega}| = \frac{e}{m} \frac{n}{2} |\vec{B} \times \vec{B}|$$

$$d = \frac{n}{2} \frac{e \hbar}{2mc}$$

$$\sigma_n = \frac{\sqrt{2}}{\gamma T (e/m) \beta B A P \sqrt{N}}$$

$\gamma T$ : lifetime

$$\beta = \frac{v}{c}$$

B: Magnetic field

A: up/down asymmetry

P: beam polarization

N: Detected events

$$\Rightarrow \sigma_d = \frac{(E/4) h}{\gamma T \beta c B A P \sqrt{N}}$$

$$\gamma T \approx 1 \text{ s}$$

$$\beta \approx 0.2$$

$$B \approx 0.25 \text{ T}$$

$$A = 0.4$$

$$P = 0.9$$

$$\Rightarrow \sigma_d = \frac{4.3 \times 10^{-21}}{\sqrt{N}} \text{ e.cm}$$

For 20KHz detection rates and  $10^4$  s running time

$$\boxed{\sigma_d = 1.0 \times 10^{-26} \text{ e.cm}}$$

$(5 \times 10^8 \text{ d/injection})$

Improving on ~~E, F, B~~ is possible w/  
higher E-fields (see B.M. edm note #39)

$\Rightarrow$  Conclusion  $10^{-26}$  e.cm or better  
statistically  
is possible. Need to study systematic  
errors: 1.5 prad

## Deuteron EDM Issues

### Work Breakdown Structure      Leadership / Responsibility

- |     |   |                           |
|-----|---|---------------------------|
| 1.1 | Storage Ring Magnet Issues                  | B.M.                      |
| 1.2 | Ring Vacuum and Electrostatic Plates Issues | <del>G.O.</del> G.O., YRS |
| 1.3 | Electric Field Monitoring Issues            | G. Bennett<br>P. Debevec  |
| 1.4 | Beam and Spin Dynamics & Monitoring         | F.F., Y.O., A.S.          |
| 1.5 | Injection Kicker Issues                     | YRS                       |
| 1.6 | Polarimeters Issues                         | E.S., G.O.                |
| 1.7 | Site Issues                                 | Source, ... L.R.          |
| 1.8 | DAQ & Slow Control Issues                   | ask Prisca                |

# Timeline

- Site Selection Lee Roberts
- Feasibility Yes (by end of summer)  
Jim Miller
- Position paper (NSAC, Holt, ...)
  - Physics
  - Background (Tensor)
- Proposal

w/in next  
two ~~—~~ three  
weeks.